

SCHOOL OF AVIATION MEDICINE
U.S. NAVAL AIR STATION
PENSACOLA FLORIDA



A COMPARISON OF PREFERENCE FOR TRAINING
WITH AN EVALUATION OF COMBAT PERFORMANCE OF PILOTS

Research Project X-718(Av-375-k)

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NAVAL SCHOOL OF AVIATION MEDICINE
U.S. NAVAL AIR TRAINING BASES
PENSACOLA, FLORIDA

RESEARCH REPORT

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WITH AN EVALUATION OF COMBAT PERFORMANCE
OF PILOTS

REPORT BY: Richard Trumbull
Lt. Richard Trumbull, H(S), USNR

Oscar Backstrom, Jr.
Lt. (jg) Oscar Backstrom, Jr., H(S), USNR

APPROVED: Louis Iverson.
CAPTAIN LOUIS IVERSON, (MC) , USN
MEDICAL OFFICER IN CHARGE

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SUMMARY

A pilot's desirability or undesirability in combat situations, expressed by fellow pilots, is employed as a criterion of combat success for comparison with preferences stated at Intermediate Training to determine to what extent such preferences correlate with and/or predict combat performance. The preferences considered are (1) those for type of combat aircraft desired, and (2) those indicated on a check list of 150 attitudinal items. The relationship with individual items is determined by means of an item analysis while large factors or clusters of items are developed through multiple contingency procedures. Data are presented and discussed for the individual sources of preference to show the reliability and nature of each. In addition, multiple contingency provides an opportunity to study the relative contribution of each source of preference in one composite picture of preference vs combat success.

CONCLUSIONS

1. More pilots who receive training for and duty in combat aircraft of high preference are rated as desired by fellow pilots than those whose assignments are in other preferences. The converse is true of men receiving low preferences.
2. Pilots who fly aircraft of 1st preference in combat after training for other aircraft tend to fall in the LOW group. Therefore, the consistency of training is a contributing factor.
3. The pattern of preferences from most desired to least desired has a significance in addition to that of 1st preference in predicting combat success.
4. In general, men of both CV and VP HIGH groups prefer any duty connected with flying to duty on the ground.
5. Men of both HIGH groups manifest a distaste for instructor duty of any kind, whether ground or flight.
6. HIGH CV men, in particular, prefer active, social recreation to inactive, solitary recreation.
7. The factors discovered here measure relatively stable, unitary characteristics predisposing toward combat success.
8. Items similar to those of the Aviation Preference Check List are capable of predicting combat success as established by the present criterion.
9. A definite pattern of personality is emerging in the role of "The unwanted man" in combat which further study should synthesize.

INTRODUCTION

During the course of World War II, it was the policy of the Navy to give high priority to individual preference when assigning men to duty. In aviation, this function was performed at the Intermediate stage of training by an Intermediate Training Selection Board which, by assigning a pilot to a certain type of specialized training, largely predetermined the type of combat aircraft which he would fly. The extent to which preferences could be granted, however, was subject to various limitations: the needs of the fleet, and special qualifications required of the pilot for optimal operation of different types of aircraft. The latter included high altitude tolerance, height and weight specifications and response to psychological tests. While these devices were introduced, tried, modified or eliminated, the preference of the pilot to fly a certain type of aircraft remained the foremost criterion for placing him in training to that type of aircraft.

It was not until the closing months of the war that data could be gathered for appraising any of the selection or placement techniques which has resulted in one man's flying a fighter type aircraft and another man's flying multi-engine aircraft. Beginning in November of 1944, a comprehensive study was undertaken in the combat areas of the Pacific to discriminate between the "good" combat pilots and the "poor" combat pilots. From the results of this study, judgments were obtained on over 2,000 pilots, on whom detailed analysis could be made from a multitude of factors contained in their past records. This present study is but a part of the major project of analysing this large body of data. It is concerned with comparing preference for aircraft type and selected items from an aviation preference check list with combat performance as established by the criterion to be discussed.

SOURCES OF DATA AND PROCEDURE

The data of this study were obtained from:

(1) A master list of over 2,000 combat pilots, as rated by fellow pilots, prepared by the Aviation Psychology Branch of the Bureau of Medicine and Surgery from criterion data obtained in the Pacific area.

(2) A pencil-and-paper test known as the Aviation Preference Check List (APCL), taken by some of these pilots at the beginning of Intermediate training.

(3) Lists of preference for operational aircraft made out by some of these pilots at the beginning of Intermediate training.

a. Preference lists: During the Indoctrination Week in Intermediate, the student was asked to fill out a preference sheet which listed six combat types of aircraft, VB2, VP, VO(VCS), VF, VTB, and VSB. (App. AI) After listing the six in order of preference, he indicated the degree of pleasure or displeasure which he would feel were he to be assigned some other type.

b. Aviation Preference Check List: (App. AII) This check list was one of two questionnaires given during Indoctrination Week for the selection of flight instructors. It consists of 150 items of two choices, one of which is to be checked as preferred over the other. These items range from types of duty to magazines, activities, companions, et cetera. The check list was included in this study because it contains a number of items wherein the student must make a choice between one type of combat duty and another, as well as items in which a choice must be made between flight and non-flight duty. It appeared to offer opportunities for a more definitive indication of preference than could be obtained from the preference lists alone.

c. Combat criteria: In November of 1944, four H(S) psychologists reported for duty in the Pacific area to interview combat pilots and obtain measures of combat proficiency for as large a group as possible. The procedure employed may be summarized as follows: Any group of pilots was gathered in a ready room or other available area. The purpose of the program was outlined to them and stress was placed upon the fact that the responses would be secure and anonymous. They were given prescribed forms (App. AIII) to fill out after the following introduction.

For CV squadrons: "Assume that you have orders detaching you at once from this Air Group and assigning you to another Air Group for a tour of combat duty. Your orders specify that - regardless of your rank or your experience - you are to fly wing on someone in the new Air Group. Write down on Line #1 - the name of any pilot, known to you personally, on whom you would be willing or pleased to fly wing in such an assignment. He may now be living or dead, may hold a rank above you or below you, and he may or may not be a member of your present Air Group. The important thing is that he should be known to

you personally and that you would be willing or pleased to fly on him in combat." For VP squadrons: "Assume that you have been incapacitated while on a combat mission and that you must turn the control of your plane completely over to your co-pilot. In this situation, of all the men you know in Naval Aviation, what man would you be best satisfied to have take over the controls to complete the mission and bring you back to your base?

"---The man you choose may be of any rank and in any squadron. He may now be living or dead. The important thing is that he should be known to you personally and that you would be satisfied to have him take over completely the control of the plane in which you are riding."

Additional information relative to the nominee's squadron, etc., was obtained. During the first phase of the program, each respondent was asked to give his reasons for each nomination by free response. Tabulation of these reasons resulted in the devising of a check list of more common reasons for use in the later phase of the program. In addition to checking those reasons which applied to his nominee, the respondent had additional space for stating other reasons not on the list which might be unique with that nominee. Respondents were requested to indicate further the three reasons which applied most specifically to their nominee. The same procedure was followed in nominating a second HIGH man.

The second half of the procedure was similar to the above. Using the reverse of the form provided, responses were obtained for the following situations.

For CV: "Again assume that you are transferred to a new squadron. This time your orders designate you as a Section leader. You are authorized to pick your own wingman from all the men known to you in Naval Aviation. In this situation, write on line 1 (here) the name of one man whom you very definitely do NOT want on your wing in combat."

For VP: "Again assume that you are transferred to a new squadron. You are authorized to pick your co-pilot from among all the men you have known in Naval Aviation. Write on line 1 the name of one man, known to you personally, whom you do NOT want as your co-pilot on a combat mission."

Reasons were indicated as before, the respondent being aided by a list of previously found "NOT wanted" traits. The three most specific reasons were checked. A second LOW man was listed with appropriate reasons in similar manner.

From this summary, it can be seen that from each respondent there were two nominees for a HIGH group and two for a LOW group. It is evident that summation of these nominations would result in the formation of three groups; HIGH where all nominations for the man were HIGH, LOW where all nominations for that man were LOW, and Indeterminate (-) where the man concerned received nominations for both categories.

Subjects: Because all data were not available for all pilots on the master list, several groups were employed in the various sections of this study to obtain the maximum N while observing requirements for standardization. The resultant groups and their composition follow:

Group 1. In comparisons showing the relationship of various items from the Aviation Preference Check List to combat success, N = 502. This is the largest group of men from the master list for which Aviation Preference Check Lists were available.

Group 2. In comparisons correlating combat success with the correspondence of assignment and preference, N = 321. This is the largest group of men from the master list for which complete preference data were available.

Group 3. In comparisons combining both items from the preference lists and items from the Aviation Preference Check List, N = 199. This is the largest group of men for which all data were available. All the members of this group are included in both groups (1) and (2).

The men of these groups were trained at Pensacola in classes entering Intermediate Training between June of 1943 and October of 1944. The average age of the group at time of entering Intermediate was 21 years. The representative nature of the sample used might be shown in a number of ways. Of greatest importance is the distribution of HIGH and LOW men. In the total group of 2080 men, 47.8% were in the HIGH group. In the test sample used for the most comprehensive section of this study (N of 199), 48.6% were so nominated. The Indeterminate nominees were not employed in this study although some data are presented for this

group for the purpose of completing tables. The distribution of Group 3 in combat assignments, according to nominations, follows:

<u>Combat Aircraft *</u>				
<u>Combat Rating</u>	<u>F</u>	<u>SB</u>	<u>TB</u>	<u>P</u>
HIGH	48	7	13	28
LOW	<u>45</u>	<u>8</u>	<u>18</u>	<u>32</u>
Total	93	15	31	60

* F designates VF (Fighters)
CV SB designates VSB (Dive-bombers)
 TB designates VTB (Torpedo-bombers)
 - - - -
VP P designates VPB (Patrol bombers,
 multi-engine)

Plan of analysis:

- (1) The relation between combat success and correspondence of aircraft choice with assignment was investigated by means of standard contingency procedures.
- (2) The frequency of particular patterns of aircraft preference and the significance of certain patterns in relation to combat success were investigated by means of contingency procedures.
- (3) The relation of choices on each item of the Aviation Preference Check List to combat success was determined by an item analysis involving a frequency count of responses to each item and the statistical significance of the resulting proportions of HIGH and LOW men.

- (4) Maximal multiple correlations of combinations of items from all the above sources with combat success were derived by means of multiple contingency. Factors predisposing toward combat success and combat failure were isolated and described.
- (5) Because preliminary analysis indicated that important differences exist between CV men and VP men, the two classifications were treated separately in all comparisons.

RESULTS AND DISCUSSION

Preference: The relationship of preference to combat ratings can be shown by a study of the 321 men included in Group 2. Inasmuch as every pilot is not able to be assigned to fly the type of aircraft he desires, the nature of preferences and their background should be considered. Of greatest importance is the fact that preference stated during Indoctrination Week at the Intermediate level of training have no foundation in experience. With but few exceptions, the students' aviation experience had been confined to preliminary training in WTS and Primary with biplanes of the N2S type and monoplanes similar to the popular Piper Cub type. His acquaintance with the types of aircraft flown in combat and the nature of the duty involved was subject to bias from aviation magazines and the popular stories which glamorized to an extreme. Some indication of this influence is shown in trends of preference which reflect the impact of popularized exploits of squadrons or Air Groups. A particular type of aircraft might have a reputation for containing innumerable "bugs" jeopardizing the pilot. As illustrations, the PV and SCL both had their period of unpopularity. Or a particular aircraft might be associated with undesirable duty as was true with PBY's during the period of greatest replacement and development of Dumbo squadrons.

To combat these misconceptions, pamphlets and lectures were developed for use during Indoctrination Week prior to the time at which preferences were stated. In addition, similar efforts were made at Primary bases where, especially in the closing months of the war, definite lecture periods were established wherein returned combat men informed the students of combat operations and greatly contributed to development of the proper perspective relative to preference.

Among other factors influencing preferences are those related to the social aspect or personality trait, e.g., some

pilots duplicated a friend's list of preferences in an effort to maintain a previously established relationship. It is not intended that these examples produce the conclusion that all preferences had inadequate basis or reflected merely transient desire. Rather, they are mentioned so that one might constantly be aware of the factors which were influencing aircraft choice. How closely these factors were related to preference as well as combat proficiency will be seen later in the personality and preference patterns found by means of multiple contingency.

Table 1 shows the preference frequencies of this group of 321 men. The popularity of certain aircraft and the unpopularity of others at the time this group arrived at Pensacola is clearly shown. The ideal situation would have resulted in assignment of each man to training leading to duty in the aircraft of 1st preference. Due to previously mentioned exigencies of war, availability of facilities, etc., some assignments had to be arbitrary. It was at this point that the other previously mentioned criteria for assignment were employed. The number of men receiving 1st preference at Intermediate, after the Intermediate Training Selection Board had considered these factors, was:

	<u>Aircraft Type</u>						<u>Total</u>
	<u>F</u>	<u>SB</u>	<u>TB</u>	<u>P</u>	<u>B</u>	<u>VO</u>	
No. stating as 1st preference:	121	22	15	65	95	2	321
Assignments:	88	19	14	58	16	0	195
% assigned to 1st preference:	73%	86%	93%	89%	17%	0%	61%

Table 2 shows the ultimate assignment of all men in Intermediate and their final fleet duty. It is seen that 65% of the men actually saw combat in the aircraft for which they trained in Intermediate. A brief picture of this shift in assignment showing the number of 1st preferences, the assignments made at Intermediate and the billets ultimately filled from this group might be extracted from Tables 1 and 2 as follows:

Aircraft Type

	<u>F</u>	<u>SB</u>	<u>TB</u>	<u>P</u>	<u>B</u>	<u>VO</u>
1st Pref.	121	22	15	65	95	2
Int. Assign.	103	62	65	69	20	2
Fleet Duty	150	34	48	89		

While the core of each operational squadron consists of men who desired that duty, certain squadrons (TB in particular) show a wide discrepancy between the number of men who desire that aircraft and the number of men which must be assigned to it for combat reasons. This is clearly indicated by the distribution shown in Table 3 where 49% of the total group are shown to be flying 1st preference in combat. Further evidence is found in the analysis of Group 3 on page 5, which shows the HIGH and LOW nominations in terms of combat aircraft flown.

The effect of consistent training in terms of preference is shown by the three following analyses. First, the combat ratings of the group fortunate enough to receive training for and combat in the aircraft of 1st preference. B and VO are eliminated due to the small size of the groups involved.

Aircraft Type

<u>Combat Rating</u>	<u>F</u>	<u>SB</u>	<u>TB</u>	<u>P</u>	<u>Total</u>	<u>%</u>
HIGH	36	2	3	32	73	52
-	2			1	3	2
LOW	32	3	4	25	64	46

This might be contrasted with an analysis of men who were assigned at Intermediate to meet quotas and whose combat duty was in the same type of aircraft as that assigned. This group is the same as the above, then, in completeness of training but they did not receive their 1st preference in the assignment.

<u>Combat Rating</u>	<u>Aircraft Type</u>					<u>%</u>
	<u>F</u>	<u>SB</u>	<u>TB</u>	<u>P</u>	<u>Total</u>	
HIGH	7	6	9	3	25	40
-			3	2	5	8
LOW	6	7	15	5	33	52

Here we see that with all other conditions held constant, the influence of a man's receiving 1st preference is evident. One further group, that composed of men who fly aircraft of 1st preference in combat after receiving training in another type in the interim emphasizes the relation between preference and consistency in training.

<u>Combat Rating</u>	<u>Aircraft Type</u>					<u>%</u>
	<u>F</u>	<u>SB</u>	<u>TB</u>	<u>P</u>	<u>Total</u>	
HIGH	6				6	33
-				1	1	6
LOW	10	1			11	61

This analysis of 1st preference per se presents the maximum influence of preference when granted and when not granted. In addition, evidence is found establishing the influence of consistent training once the preference has been granted. The fact that a man received his first choice does not alone predispose him to success in combat but the fact alone that he receives an assignment which was among his low choices does predispose toward failure. A complete picture of the part played by assignment of men to low preferences was precluded by the extent to which the Selection Board was successful in carrying out the intent of the overall policy of granting preference within limitations of quotas. Thus, the men who received low preferences are so few in number that a definitive test of the effect of receiving them is impossible. The indications are that if this sample had included more men in the low preference categories, the importance of granting preference would have been readily discernible in the proportion of combat failures these categories would have contained.

Preference patterns: The relative preference that a pilot, e.g., a VF pilot, has for his combat assignment is shown not only in the rank order which he assigns F in his list of preferences (as first, second, third choice, etc.), but also in the rank order assigned to other types and in the associations within his list of F with other types. For example, the three pilots whose orders of preference are reproduced below all placed F as 1st choice but the strength of their preference for F may be very disparate as might be the reasons for preferring F.

Pilot A - F SB TB VO B P

Pilot B - F B P SB VO TB

Pilot C - F P VO SB TB B

The importance of such differences as appear in these orders of preference may best be realized if one imagines himself to be in the position of a member of an Intermediate Training Selection Board whose quota for VF can accommodate only half of those who list F as first choice. Such a member evidently must consider the fact that the arrangement or pattern of preferences may have a significance in addition to that of the choices per se. Moreover, it is evident that each choice - not only the first and second choices - may be of significance in predicting combat success. It would be reasonable to hypothesize, for example, that Pilot A, who shows a marked aversion to multi-engine aircraft (by listing B and P as fifth and sixth choices), might have an additional predisposition for VF aircraft that Pilots B and C lack. In other words, the low preference choices may have a positive importance, as well as the negative importance which has been demonstrated. In addition, Pilot A demonstrates a pattern of what will be termed "blocked" preferences; i.e., all single engine aircraft are in a sequence and both multi-engine aircraft are together.

An analysis of the patterns of preference was made in order to discover which groupings or clusters of choices predisposed to combat success and which predisposed to combat failure. For this analysis, the largest groups obtainable were used: i.e., all men who had listed six choices on a preference list, (App. I), were included whether or not other data were available for them. (It was possible to augment Group 2 for this analysis by including in the CV group men whose fleet assignment was listed as "CV without specialty" or "Fighter-Bomber".) The first step in this analysis was to tabulate, for the CV and VP combat groups separately, the number of times each aircraft type was listed in each posi-

tion by men rated HIGH and men rated LOW. These tabulations, which are shown in Tables 4 and 5, demonstrate the importance of choices other than 1st choice. Of the items which show potential value as predictors, about half tend to identify members of the HIGH group (positive predictors) and half tend to identify members of the LOW group (negative predictors). Following this tabulation process, all patterns were transcribed onto cards which were sorted manually in order to discover which permutations and combinations of choices had potential value either as positive or negative predictors. Thirteen such combinations were identified. They are shown in Table 6, together with percentage frequencies. Preliminary summations of these classes showed that while various permutations would aid prediction of success, especially for the VP group, additional variables were desirable. For this reason, no attempt was made to obtain maximum multiple coefficients with the pattern variables alone. It is worthwhile to draw special attention to the nature of one of these pattern variables: namely, "blocking" the choices. (See items 1 and 11) "Blocking" the aircraft types - that is, arranging them into generically similar groups - would appear to be the "normal", logical procedure. If one knew that he might not receive his first choice but was likely to receive one of his first three choices, he would "normally" make his second and third choices as similar to his first choice as possible; similarly, one would "normally" group low choices as to type. Since this is so, deviations from "blocking" which are shown by a large number of individuals, such as Items 4, 5, 12, 13, and 14, are worthy of special notice, inasmuch as they reflect particular modes of thinking and behavior which may be associated with combat success or failure. It is hazardous to impute motivations or reasons for these and other deviations but it seems safe to say that these patterns are distinctive and arise, if not from the same reasons in the case of every individual, at least from a common syndrome of reasons.* As such, they are in a sense measures of attitudes and/or traits as well as indications of the preference or aversion.

*A possible and plausible reason for the aversion to TB and VO may lie in the rumors which were once wide-spread among aviation cadets and aircrewmen that TBF and OS2U squadrons had abnormally high combat losses. In the course of Selection Board, NAGS, and interviewing duty, the authors many times heard both aircraft called "flying coffins" by men who were unable to give a reason for the epithet. These and other aircraft also "developed" highly mythical defects of design and construction from time to time.

Aviation Preference Check List: The Aviation Preference Check List, (App. AII), was devised as a test for Flight Instructor selection and was not designed to be a predictor of combat success or acceptability. Reasons for including it in this study have been mentioned elsewhere. APCL answer sheets were available for 502 of the combat men on the master list. Of the 150 items which appear in this test, there were 34 which discriminated between the HIGH and LOW groups at significant levels of confidence. These items with the preferences checked by the HIGH and LOW groups at the various levels of confidence are listed in Tables 7 and 8. As was mentioned previously, the CV men were separated from the VP men for analysis on the basis of early findings of dissimilarity. Table 7 presents the preferences of the CV group and Table 8 presents the preferences of the VP group. One caution in particular should be borne in mind in interpreting Tables 7 and 8; namely, that on only 5 out of the 34 items do a majority of the LOW men make a choice different from the majority of the HIGH men. That is, as a group, the LOW men tend to make the same choices as the HIGH men, but the proportion of the LOW group which makes the "favorable" choice is significantly less than the proportion of HIGH men who do so. The typical LOW men, then, are distinguished from the typical HIGH men not by making all or even a large number of the LOW choices, but simply by making more of them than the HIGH men. Conversely, typical HIGH men make a number of LOW choices but fewer such choices than do the LOW men. Table 9 illustrates this situation, using the 18 items found to differentiate HIGH and LOW CV men of the smaller group (Group 3). The score is the number of items answered favorably; i.e., the number of HIGH choices. The difference in the distribution of scores for the two groups is highly reliable statistically, as evidenced by a p of .00000 indicating not even 1 chance in 100,000 that the difference could arise from random fluctuation or "accident". Moreover, it will be noted that it is possible to set various "cutting scores" which reject large proportions of the LOW men, but few of the HIGH men. For example, by requiring that men accepted for combat training have a score of 14 or more of the total of 18 items, we would accept 89.7% of the HIGH men but only 44.6% of the LOW men and would reject 55.4% of the low men, but only 10.3% of the HIGH men.

Unfortunately, only one item differentiated between the HIGH and LOW men of the smaller VP group, so a similar analysis for VP men was not possible. As a matter of interest, this one item at a 7% level of confidence found the LOW men preferring Ground School Instructor duty and the HIGH men preferring duty as a Meteorologist. It was possible, however, to make one analysis of the VP men which produced rather inter-

esting results. Scoring the VP men on the CV differentiating items, it was possible to establish that the VP men were more similar to the LOW CV men in their choices than they were the HIGH CV men.

While one must proceed with caution in interpreting a limited number of items, certain consistencies are present and certain conclusions are warranted:

1. In general, men of both CV and VP HIGH groups prefer any duty connected with flying to duty on the ground.
2. Men of both HIGH groups manifest a distaste for instructor duty of any kind, whether ground or flight.
3. HIGH CV men in particular prefer active, social recreation to inactive, solitary recreation.
4. A more nebulous distinction is found in the greater frequency of men in the LOW CV group who prefer such items as: wear a dress uniform, military drill, associate with senior officers, arguments, tell others how to, referee a game, be leader in V formation, give orders, and who, in general, are more inclined to accept ground duty with prestige value in preference to any flight billet. There is a consistency which obtains in these items although, in toto, they seem to defy grouping under one heading or designation as a personality type.

The main contribution of this analysis is the demonstration that items similar to those of the Aviation Preference Check List may have considerable utility in predicting combat success. Certain items of this check list have been shown to have such value. Their use as a basis for another, extended, check list or questionnaire would serve a definite function in further development of selection tests. The authors are not unaware of the similarity between some of these items and those already incorporated in the Biographical Inventory which is used for initial selection in the flight training program where ability to succeed in the program was the criterion. Without a doubt, analysis under way on items of that test in relation to these same combat groups will produce certain items or indicators of personality patterns which, together with those gleaned from this check list, will be more than adequate

as a basis for further study. From such a composite, a more definite classification of the personality type which seems to exist here could be accomplished. Whether that type is an artifact of the selection program in operation when these men were processed and the prevalence of such a type in society as a whole can be established in no other way.

MULTIPLE CONTINGENCY COMPARISONS AND ISOLATION OF FACTORS.

The discussion has hitherto shown that the pilot's indicated choice of aircraft, the pattern of his preferences as to aircraft types, and his responses to various attitudinal items on the Aviation Preference Check List, all contribute to pre-estimation of the probability of his success in combat. No single variable which has been discussed is alone predictive enough to be used economically in screening pilots for future combat duty. While many of the variables discussed improve prediction over chance, none of them by itself correctly classifies a proportion of the group significantly large to enable selection authorities to accept only those men who pass the test item or to reject only those who fail it - the test item in this case being one expression of preference, one particular pattern of preferences, one question on the Aviation Preference Check List, etc. Accordingly, it was sought to combine these variables in a manner which would maximize their predictive value. In general, there are two ways to combine a series of categorical (i.e., not numerical and non-continuous) variables such as these in order to produce a composite test. The first, and simpler, method is to stipulate that a candidate must "pass" - that is, fall into the category which tends to be associated with the high criterion group - a certain number of the individual test items. This number is determined empirically by plotting the distribution of numbers of test items passed by both high and low criterion groups and choosing a dividing line or "cutting score" which best separates the groups. This method was employed in the comparison previously shown between HIGH and LOW groups on the significant items of the Aviation Preference Check List. It is important to note that this method does not stipulate which of the test items the candidate must pass, but only the number. In other words, it does not take into account the fact that some test items and, particularly, some combinations of test items are more predictive of success than others. The other method is to employ a technique of multiple association in order to select that combination of test items which will produce a maximum overall correlation with the criterion. Two standard techniques of multiple association, the techniques

of multiple regression and multiple contingency, are available. The two techniques are similar in that each results in an overall coefficient of correlation but differ in other respects. Each possesses peculiar advantages.*

Because multiple contingency results in the formation of readily identifiable classes of individuals who pass or fail the same test items, it performs roughly the same functions as factor analysis while simultaneously maximizing prediction. In other words, an overall coefficient of association is obtained and, at the same time, one may readily identify the underlying factors around which the various individual items cluster. In this way, one not only obtains a predictive battery, but also is enabled to arrive at some generalizations about HIGH men and LOW men. Accordingly, all statistically significant or promising items for the CV and VP groups, respectively, were treated by multiple contingency, overall coefficients of correlation were obtained, and factors predisposing to combat success and failure were identified.

Table 10 shows the contingency table which resulted from the application of multiple contingency to the significant items of the CV group, with the contribution of each factor shown separately. The multiple coefficient of association is .57 which is high for selection batteries of this type and for a criterion which has possible subjective elements. The magnitude of the coefficient is all the more remarkable because the CV group, being composed of VF, VSB, and VTB pilots, might be presumed to be heterogeneous in ways that would diminish such a coefficient. A more direct and graphic way of interpreting the table is to examine the frequencies in the four cells. It is evident that by accepting only men who show the two positive factors, we would accept 50 out of 68 HIGH men, or 73.5% of the HIGH group and only 11 out of 72 LOW men, or 15.3% of the LOW group. Moreover, we would accept a group which would be composed of 82% (50/61) passers and 18% (11/61) failures, instead of the 49% (68/140) passers and 51% (72/140) failures which would be accepted if the two factors were not applied. Table 11 shows similar contingency tables for the VP group, with results which are equally striking. Three contingency tables were prepared for this group: One (Table 11-A) which maximizes

*H.M. Johnson. Multiple contingency versus multiple correlation: an old time-saving way of handling multiple contingency. Am. J. Psychol., 57, 1944, 49 - 63.

the ratio of accepted passers to accepted failures, but rejects a large proportion of potential passers along with the failures; and two (Tables 11-B and 11-C) which augment the ratio of rejected failures to rejected passers, but accept a large proportion of potential failures along with the passers.* By requiring all accepted VP candidates to show the characteristics which define the two positive classes in Table 11-A, we would accept 18 out of 28 HIGH men, or 64.3% of the HIGH group, and only 4 out of 32 LOW men, or 12.5% of the LOW group. The accepted group would be composed of 82% (18/22) passers and only 18% (4/22) failures, and the rejected group would be composed of 74% (28/38) failures and 27% (10/37) passers. The rejected group contains 87% of the total number of LOW men, and 36% of the total number of HIGH men. Use of such a criterion would be based upon the potential supply of candidates inasmuch as where the supply is limited it would be impractical to reject a group containing so large a proportion of the potential passers. Hence Tables 11-B and 11-C were also prepared. In these two tables, it is the rejected classes who are to be viewed as the factor-classes and the accepted classes as the remainders. In Table 11-B, it may be seen that simply by rejecting all pilots who did not "block" their choices according to type of aircraft**, we would reject 56.3% of the failures and only 21.4% of the passers. By "salvaging" the additional passers, however, we are forced to accept a group which contains 43.8% of the failures, in contrast to the 12.5% accepted by the previous table. The last table rejects only a sub-group of the group rejected by Table 11-B. The group rejected did not "block" their preferences, and also expressed attitudes on the Aviation Preference Check List which differ from those expressed by the HIGH men. By limiting the rejection to this sub-group, we reject a group composed of 100% failures. We accept a group which includes

* It is usually the case in such selection problems as these that several cutting points can be set, depending upon the primary purpose of the selection; i.e., whether the primary purpose is to reject the potential failures, or to accept potential passers. It is rare that one cutting point can be found which will accomplish both purposes as was true here for the CV group.

**This characteristic defines Factor-class C.

all the passers, but also includes 56.3% of the failures, a proportion which may be impractically high for a training program to accept.

For readers who are unfamiliar with correlation and contingency techniques, one note of caution should be inserted at this point; namely, that every selection battery must be subjected to successive trials on large samples before it can be regarded as stable and capable of producing the same results on samples other than the one from which it is derived. It is likely that if these batteries were applied to other groups of pilots the obtained correlation and obtained improvement in pre-classification would differ from those presented here. Consideration of the nature of the factors discovered, however, (see below) would indicate that these batteries measure relatively stable, unitary characteristics predisposing toward combat success which a larger battery of similar items chosen by comparisons on successive larger groups, would measure with stability. In other words, while individual items of this battery to be discussed might not "hold up" and produce so good results on other groups, it is established a set of such items can be validated and cross-validated on other groups which would give results of useful predictive value.

The Factors: Each of the factors named in Tables 12 and 13 is defined by a set of characteristics shown by all members of the factor-class. In addition, each factor subsumes a set of characteristics which a large proportion, though not all, of the factor-class exhibit - i.e., characteristics which tend to "cluster" around a set of characteristics which defines the factor-class. The nature of the individual factor was identified, and an appropriate label was selected for it by examination of all these characteristics. The importance of these factors lies in the fact that they reveal the nature of the difference between the HIGH and LOW men. It is a truism that the items which go to make up a psychological instrument are imperfect measures and are subject to fluctuation in reliability and predictive value. Presumably, the nature of the entities they attempt to measure remains relatively unchanged. Knowledge of the nature of those entities makes possible increased accuracy of prediction through the addition of other tests which measure the same thing. These factors, then, may be viewed as a preliminary and tentative description of some of the characteristics which differentiate pilots who are "wanted" in combat from those who are "not wanted". Each of the factor-classes shown in Tables 12 and 13 is thus composed of individuals who made the same responses to all of a certain set or constellation of items, and many of whom made the same responses to various other "clustering" items. The fact that

members of any one class have a particular characteristic, then, does not preclude members of another class from also exhibiting it; distinction among the classes is primarily a question of the pattern of characteristics and the degree to which members of the various classes possess it.

VP Factors: The primary positive factor among VP pilots (Table 11-A) is labelled "Strong aversion to instructor duty". The reader may see for himself the indicated strength of this aversion by noting the responses of the members of this class to five items from the Aviation Preference Check List given in Table 12. It will be noted that of a variety of alternatives to various types of instructor duty, the members of this class are nearly unanimous in preferring those alternatives, whatever they are. The remaining pilots also express aversion to some types of instructor duty, but apparently it is not so marked. The particularly crucial items are Numbers 1, 2 and 3, in which instructor duty is unanimously rejected by members of the factor-class, but is preferred by the majority of the members of the remaining classes. The second positive class is labelled "Strong systematic preference for multi-engine, plus aversion to VO/VCS". All of the members of this class:

- (1) Listed B and P as their first and second choices.
- (2) Thus received either their first or second choice.
- (3) "Blocked" their choices.
- (4) Listed VO as their last choice (with TB as fifth choice.)

To a considerable extent, this class overlaps Factor-class A. Eleven of the 16 members of Factor-class A show characteristics (1), (2), and (3), and in addition one out of the 16 may also be classed in Factor-class B. The first three characteristics of choice pattern listed above are most positive when combined with the other characteristics, but that they are positive even when they are not "reinforced" by the other characteristics of Classes A and B may be seen by referring to Table 11-B. The accepted group in this table is defined only by these characteristics. The rejected group is defined by their failure to "block" their choices. It is hazardous to interpret "blocking" as evidence of a particular faculty of logic, but this table is tentative evidence that the best VP pilots apparently make a choice not so specifically for VP as for multi-engine aircraft in general, as opposed to CV and VO. In other words, their preferences tend to be systematic.

As stated previously, the rejected class in Table 11-C is a sub-group of the rejected class in Table 11-B. This class is defined by two items:

- (1) Failure to "block" choices.
- (2) Stating preference for duty as Educational Officer rather than Meteorologist.

In addition, the members of this class are inclined to accept two other billets involving instruction which the members of the remainder class emphatically reject. It is not apparent what, if any, general tendency this class reflects, except the negation of the positive items of Factor-class A. Table 11-C is offered simply as evidence that the pertinent items may be used to select either primarily for rejection or primarily for acceptance.

CV Factors: Table 13 lists the make-up of two positive CV factor-classes, two negative CV factor-classes, and a negative remainder-class.

In the following discussion it will be important to bear in mind that the three negative classes are derived from the residual left by subtraction of the positive classes. They are, in other words, first defined as not exhibiting Factor A or Factor B. In addition, each has further defining characteristics, but these alone cannot be used to define the negative class; if they were, some cases in Factor-classes A and B would fall into the negative classes.

Factor A is labelled in Table 13 "The wanted man". (After due deliberation, the designation "The wanted man" was used as a standardization measure because this term had been employed in the restricted preliminary reports of the combat criterion study from the Aviation Psychology Branch in Washington. The authors believe that the APCL suggestion of a definite personality type gains further support from the multiple contingency study and that further analysis will result in a more definitive designation.) The set of characteristics which this appellation denotes perhaps will make easy a generalized picture of the "type" of man it represents, particularly to those who have done daily work in the flight training program. In general, this factor denotes:

- (1) A sort of non-systematic preference for CV aircraft or, at least, satisfaction with them. CV preference is evidenced by the high choice of

F and SB, and by the low number of individuals who made the multi-engine pair their first two choices. The lack of the same sort of "system" that successful VP pilots apparently employed is evident in that none of these men placed three CV types as the first three choices; the only ones among them who "blocked" choices were 4 men who chose the multi-engine group.

- (2) A susceptibility to fads or social trends in choices, as evidenced by the facts that:

(a) Almost the entire group placed B among the first three choices. The interpretation that this is a social trend, reflecting cadet-barracks "bull sessions", is based upon the fact that VP operations were receiving widespread attention at the time this group made their choices, and the fact that the choice of B apparently is not indicative of a primary desire for multi-engine training. It occurs unassociated with P as often as associated with it, and in only six cases were the two listed as first and second. Also, in this group, the choice of P occurs only twice unassociated with B (i.e., without B in the first three choices as well), whereas B is listed 23 times in the first three choices unaccompanied by P.

(b) TB does not appear among the first three choices. Reference to Table 1 will readily indicate that TB was highly popular among this group when choices were made.

(c) TB and VO are listed as fifth and sixth choice by half of the group. Also, the members of this Factor-class who listed TB and VO fifth and sixth constitute one half of the total group who did so even though the Factor-class is but 39% of that total sample.

- (3) A preference for activities involving action or popular socialized activities, in contrast to sedentary activities and work involving routine concentration.

CV Factor B in Table 13 is labelled "The wanted man with strong CV preference". Reference to the table will show where-in this label is appropriate. The two factors are distinguished entirely by items referring to the listed choices of aircraft. The two factors are virtually indistinguishable as to the personality or attitude items from the Aviation Preference Check List. The item which clearly distinguishes the two classes is the failure of the members of Factor-class B to include B among their first three choices. Accepting Factor-classes A and B leaves a residual of 18 HIGH men and 60 LOW men. From this residual, two negative factors can be isolated. The largest cohesive negative class is defined by the failure of its members to include more than 1 CV type among their first three choices. The members of the class so defined do not universally possess any other characteristic, in common, but a large proportion of them possess one or more characteristics which make distinction of the class and interpretation of it relatively easy. Because of the tendency of the items which compose it and cluster around it, this factor is labelled "The misplaced multi-engine man or instructor". It might particularly be noted that 74% of this class, which contains 24 LOW men and only 3 HIGH men, flew aircraft of their third, fourth, fifth, or sixth preference in combat, as against 15 to 36% of men of other classes who did so.

Negative Factor D is strictly defined by only one item, inclusion of all three CV types in the first three choices, but another item, stated preference for technical responsibility rather than supervisory responsibility, is so closely associated that it may be used as well. Only one man in this factor-class did not state this preference. Factor D is a clear antithesis to Factors A and B. It resembles A in only one item (D5), and although it resembles B on the preference items, it is clearly differentiated from B by items D5, D6, and D7. But while its opposition to the two positive factors is clear, the nature of the factor itself is somewhat elusive. Several of the responses listed are contradictory, and they are altogether difficult to harmonize unless one postulates from their contradictory nature, and from the nature of some of the individual choices, a type of personality quite different from that implicit in Factors A and B. Factor-class D subsumes 18 LOW men and 6 HIGH men.

The remainder-class left after subtraction of Factor-classes C and D consists of 18 LOW men and 9 HIGH men, who have in common a pattern of choices consisting of B and two CV types in the first three positions of preference. The class is readily distinguishable from Factor-classes B, C, and D on the basis of preference items, but it is not distinguished from Factor-class A by any single item. The members of this remainder-class have, in general, the characteristics of Factor-class A, but not in the same proportions or the same patterns.

Comparison of CV and VP Factors: The reader probably has noted in the course of this discussion the difference in the type of items which distinguish HIGH from LOW VP pilots and those which distinguish HIGH from LOW CV pilots. The most striking contrast which appears is the positive influence of "blocking" - that is, grouping choices according to type - in the VP group, and its mainly negative influence in the CV group. The other outstanding difference is not a contrast, but leads one to infer a possible difference in emphasis of attitude and outlook between successful VP pilots and successful CV pilots; namely, the difference in the type of attitudinal items which have predictive value for each of the two groups. The items successful in predicting VP success all pose a choice between instructor duty and some other duty; whereas the items successful in predicting CV success have in general to do with aspects of personality, tastes, and social habits. One serious limitation to the usefulness of such evidence and, perhaps to any inquiry based upon it, is the fact that these data were obtained upon a wartime population of Naval aviators who may not have the same attitudes, tastes, and habits as succeeding peacetime populations. Except for persisting prejudices or tenets, attitudes are notoriously unstable, both in the individual and in the population at large, and it is the more conservative procedure not to place great dependence upon attitudinal items until they have been thoroughly tested. Fortunately, these comments do not apply to a large body of the biographical data and data from tests of aptitude and intelligence which has been accumulated during the war. These tests do not depend so greatly upon attitude and may be expected to supply items which have both stability and predictive value.

It remains to make a final estimation of the importance of choice. It has previously been noted that, while receiving his first preference or a high preference, does not predispose a man to inclusion in the HIGH group, receiving a low preference gives a slight predisposition toward inclusion in the LOW group. It also has been noted that the cases of assignment to low preference are so few that its effect is not readily discernible upon the total population.

The multiple contingency comparisons presented above, however, demonstrate unequivocally that the correspondence between a man's choice and his fleet assignment is highly correlated with success within sub-groups of the population. That is, in combination with other characteristics predisposing toward combat success, satisfaction with obtaining aircraft of high preference aids materially in placing a man in the HIGH group; in

combination with other characteristics predisposing toward combat failure, assignment to aircraft of low preference aids materially in placing a man in the LOW group. It will be recalled, for example, that the fleet assignment of 74% of the negative Factor-class C of the CV group was 3rd, 4th, 5th, or 6th preference. Other less tangible advantages with respect to morale and individual satisfaction add their weight, but the figures alone justify the conclusion that the practice of attempting to grant the expressed preference of the flight trainee pays off in later combat proficiency.

TABLE 1

Frequency of preferences for Group 2

<u>Preference Position</u>	<u>Aircraft Type</u>						<u>Total</u>
	<u>F</u>	<u>SB</u>	<u>TB</u>	<u>P</u>	<u>B</u>	<u>VO</u>	
1st choice	121	22	15	65	95	2	320*
2nd choice	51	69	29	65	101	6	321
3rd choice	60	76	62	28	38	57	321
4th choice	48	80	59	38	57	40	322*
5th choice	24	55	79	78	18	67	321
6th choice	<u>18</u>	<u>19</u>	<u>77</u>	<u>46</u>	<u>12</u>	<u>149</u>	321
Total	322*	321	321	320*	321	321	

*One man listed F twice omitting P.

TABLE 2

Distribution of Intermediate Assignments VS FleetDuty for Group 2

<u>Intermediate Assignments</u>	<u>Fleet Duty</u>						<u>Total</u>
	<u>F</u>	<u>SB</u>	<u>TB</u>	<u>P</u>	<u>B</u>	<u>VO</u>	
F	85	12	5	1			103
SB	38	18	5	1			62
TB	24	4	37				65
P				69			69
B	2			18			20
VO	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>			<u>2</u>
Total	150	34	48	89			321

TABLE 3

Preference vs Combat Success

Criterion Group	Fleet Aircraft	Preference Position Choice						Total	% due to last 4 Choices
		6th	5th	4th	3rd	2nd	1st		
HIGH	F		4	1	6	18	42	71	15.5
-							2	2	
LOW		2	4	6	11	10	42	75	30.7
HIGH	SB			2	5	5	2	14	50.0
-									
LOW		1	2	4	3	7	4	21	47.6
HIGH	TB	2	3	3	7	3	3	21	71.4
-				2		1		3	
LOW			1	1	7	11	4	24	37.5
HIGH	P	1	2			10	32	45	6.7
-						2	2	4	
LOW		<u>1</u>	<u>1</u>	<u>1</u>	<u>3</u>	<u>11</u>	<u>25</u>	42	16.7
Total		7	17	20	42	78	158		
%		2.2	5.3	6.2	13.0	24.2	49.1		

TABLE 4

Frequency with which HIGH and LOW men in CV group listed each aircraft type in each position of preference.

Pref. Position	Aircraft Type											
	F	SB	TB	P	B	VO						
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
HIGH 1st	77	51.7	14	9.4	10	6.7	2	1.3	43	28.9	3	2.0
LOW	99	54.1	16	8.7	11	6.0	8	4.4	47	25.7	2	1.1
HIGH 2nd	34	22.8	49	32.9	7	4.7	24	16.1	35	23.5	0	0.0
LOW	26	14.2	50	27.3	22	12.0	32	17.5	48	26.2	5	2.7
HIGH 3rd	15	10.1	43	28.9	39	26.2	19	12.8	23	15.4	10	6.7
LOW	27	14.7	50	27.3	45	24.6	27	14.7	23	12.6	11	6.0
HIGH 4th	11	7.4	33	22.1	27	18.1	32	21.5	29	19.5	17	11.4
LOW	16	8.7	40	21.8	30	16.4	30	16.4	41	22.4	26	14.2
HIGH 5th	11	7.4	5	3.4	37	24.8	47	31.5	11	7.4	38	25.5
LOW	11	6.0	22	12.0	37	20.2	58	31.7	13	7.1	42	22.9
HIGH 6th	1	0.7	5	3.4	29	19.5	25	16.8	8	5.4	81	54.4
LOW	4	2.2	5	2.7	38	20.8	28	15.3	11	6.0	97	53.0

N - HIGH - 149

N - LOW - 183

TABLE 5

Frequency with which HIGH and LOW men in VP group listed each aircraft type in each position of preference.

Pref. Position	Aircraft Type											
	F		SB		TB		P		B		VO	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
HIGH	2	4.3	1	2.1	0	0.0	34	72.4	10	21.3	0	0.0
1st												
LOW	4	8.5	0	0.0	0	0.0	27	57.5	16	34.1	0	0.0
HIGH	3	6.4	1	2.1	0	0.0	10	21.3	33	70.2	0	0.0
2nd												
LOW	3	6.4	1	2.1	0	0.0	14	29.8	25	53.2	4	8.5
HIGH	13	27.7	1	2.1	0	0.0	0	0.0	4	8.5	29	61.7
3rd												
LOW	16	34.1	7	14.9	1	2.1	3	6.4	5	10.6	15	31.9
HIGH	17	36.2	17	36.2	9	19.2	0	0.0	0	0.0	4	8.5
4th												
LOW	13	27.7	17	36.2	7	14.9	1	2.1	1	2.1	8	17.0
HIGH	4	8.5	21	44.7	19	40.4	2	4.3	0	0.0	1	2.1
5th												
LOW	3	6.4	17	36.2	14	29.8	1	2.1	0	0.0	12	25.5
HIGH	8	17.0	6	12.8	19	40.4	1	2.1	0	0.0	13	27.7
6th												
LOW	8	17.0	5	10.6	25	53.2	1	2.1	0	0.0	8	17.0

N - HIGH - 47

N - LOW - 47

TABLE 6

Common Patterns of Preference

<u>Pattern</u>	<u>Percentage Showing Pattern</u>	
	<u>LOW</u> <u>(N-47)</u>	<u>HIGH</u> <u>(N-47)</u>
VP GROUP		
1. "Blocked" according to similar type, as; B P VO F SB TB, TB F SB VO P B, VO P B SB TB F.	42	83
2. First 2 choices include B <u>and</u> P.	76	89
3. Last 2 choices include SB.	45	57
4. First 3, but not first 2, choices include B and P.	15	4
	<u>LOW</u> <u>(N-183)</u>	<u>HIGH</u> <u>(N-149)</u>
CV GROUP		
5. First 3 choices include 2 CV, 1 non-CV.	39	46
6. First 2 choices include F or SB.	78	85
7. First 2 choices do not include TB.	82	88
8. Last 2 choices include TB and VO.	26	34
9. First 3 choices include B and P.	25	16
10. First 3 choices include F, SB, and TB.	27	24
11. "Blocked".*	31	27
12. First choice is B, but P is not among first 3.	8	15
13. B among first 3 choices; choices not "blocked".	54	61
14. Last 2 choices include TB and VO; choices not "blocked".	21	32

*Items 1 and 11 are identical.

TABLE 7

Paired Items from the Aviation Preference Check List
which Differentiate HIGH and LOW CV Men

Item No.	Level of Significance	HIGH	LOW
		A significantly larger number of HIGH men than LOW men made these choices.	A significantly larger number of LOW men than HIGH men made these choices.
1	.01	Fighter pilot	Operations officer
2	.01	Patrol boat pilot	Meteorologist
<u>3</u>	.07	Navy transport pilot	Operations officer
4	.07	Instrument flight instructor	Athletic officer
5	.01	Navigator on patrol boat	Ground school instructor
6	.01	Navigator on patrol boat	Student advisory officer
7	.05	Navigation patrol bomber	Operations officer
8	.01	Navy transport pilot	Primary flight instructor
<u>9</u>	.01	Patrol boat pilot	Primary flight instructor
10	.01	Operations officer	Ground school instructor
<u>11</u>	.05	Athletic officer	Ground school instructor
12	.01	Go to movies	Read a book
<u>13</u>	.01	Visit a friend	Write letters
<u>14</u>	.01	Sporting page	Comics
<u>15</u>	.05	Readers Digest	Popular Mechanics
<u>16</u>	.05	Play table tennis	Play cards
<u>17</u>	.07	Motorboating	Sailing
<u>18</u>	.05	Supervisory responsibility	Technical responsibility
<u>19</u>	.07	Work involving few details	Work involving many details
<u>20</u>	.07	Work in one location	Change from place to place
21	.07	Reading	Arguments
<u>22</u>	.05	Be grounded for physical defect	Be killed in crash
<u>23</u>	.01	Athletics	Military drill
<u>24</u>	.01	Play a game	Referee a game
<u>25</u>	.05	Follow orders	Give orders
26	.05	Repair a motor	Tell others how to
<u>27</u>	.05	Associate with junior officers	Associate with senior officers
<u>28</u>	.07	Wear fatigue clothes	Wear a dress uniform
<u>29</u>	.07	Be wing man in V formation	Be leader in V formation

The numbers of items which also differentiate the HIGH and LOW men of the smaller sample (Group 3) used in the multiple contingency comparisons are underlined.

TABLE 8

Paired Items from the Aviation Preference Check List
which Differentiate HIGH and LOW VP Men

Item No.	Level of Significance	<u>HIGH</u>	<u>LOW</u>
		A significantly larger number of HIGH men than LOW men made these choices.	A significantly larger number of LOW men than HIGH men made these choices.
1	.01	Navigator on patrol boat	Student advisory officer
2	.01	Navy transport pilot	Primary flight instructor
3	.07	Observation scout pilot	Primary flight instructor
4	.05	Meteorologist	Ground school instructor
5	.07	Meteorologist	Educational officer
6	.07	Bomb as you saw fit	Bomb under specific orders
7	.05	Farm life	City life

TABLE 9

Contingency table showing, for CV men, the correlation between combat success and a score based upon significant items of the A P C L

	Score	LOW		HIGH		Total
		Freq.	%	Freq.	%	
<u>Accepted</u>	18	0	0.0	2	2.9	2
	17	3	4.2	4	5.9	7
	16	5	6.9	24	35.3	29
	15	13	18.1	21	30.9	34
	14	11	15.3	10	14.7	21
	13	11	15.3	5	7.3	16
	12	10	13.9	1	1.5	11
	11	13	18.1	1	1.5	14
<u>Rejected</u>	10	2	2.5	0		2
	9	4	5.6	0		4
Total		72	100.0	68	100.0	140

Statistics:

Chi-square = 40.0

p (probability that the obtained chi-square arises from random fluctuation) = .00000

Either 12, 13, or 14 may be used as a "cutting score", dividing the ACCEPTED from the REJECTED.

TABLE 10

Multiple contingency table showing for CV men the multiple correlation of various preference and attitudinal items, grouped into factors, with combat success.

		LOW		HIGH		Total
		Freq.	%	Freq.	%	
ACCEPTED	Factor-class A	6	8.33	36	52.92	42
	Factor-class B	<u>5</u>	<u>6.95</u>	<u>14</u>	<u>20.58</u>	<u>19</u>
	Total accepted	11	15.28	50	73.50	61
REJECTED	Remainder-class 1	28	38.89	4	5.88	32
	Remainder-class 2	13	18.06	5	7.35	18
	Remainder-class 3	<u>20</u>	<u>27.78</u>	<u>9</u>	<u>13.23</u>	<u>29</u>
	Total rejected	61	84.73	18	26.46	79

TOTAL		72	100.00	68	100.00	N=140

Statistics:

Chi-square = 46.36

p (probability that the obtained chi-square arises from random fluctuation) = .000000

r (coefficient of correlation) = .57

gamma (number of misplaced individuals correctly reclassified by accepting only Factor classes A and B)* = 40

r' (coefficient of correctivity)* = .57

*The coefficients gamma and r' are included primarily for readers familiar with contingency techniques. Gamma denotes "the number of individuals who would most probably have been mal-classified by a worthless test, or by chance, but who would have been properly reclassified by this test". r' is the proportion of mal-classification removed by this battery which would be present if a worthless battery were applied. These coefficients are derived and described in H.M. Johnson "A useful interpretation of Pearsonian r in 2 X 2 contingency-tables." Am. J. Psychol., 57, 1944, 236-242, from which the definition of gamma is quoted.

TABLE 11

Multiple contingency table showing for VP men the multiple correlation of various preferences and attitudinal items, grouped into factors, with combat success.

A

Grouped primarily to maximize proportion of accepted HIGH men.

		LOW		HIGH		Total
		Freq.	%	Freq.	%	
ACCEPTED	Factor-class A	3	9.38	13	46.42	16
	Factor-class B	<u>1</u>	<u>3.12</u>	<u>5</u>	<u>17.86</u>	<u>6</u>
	Total accepted	4	12.50	18	64.28	22
REJECTED	Remainder	<u>28</u>	<u>87.50</u>	<u>10</u>	<u>35.71</u>	<u>38</u>
TOTAL		32	100.00	28	100.00	60

Statistics:

Chi-square = 16.60

p (probability that the obtained chi-square arises from random fluctuation) = .0002

r (coefficient of correlation) = .53

gamma (number of misplaced individuals correctly reclassified by accepting only Factor-classes A and B) = 15

r' (coefficient of correctivity) = .31

B

Grouped primarily to maximize proportion of rejected LOW men.

		LOW		HIGH		Total
		Freq.	%	Freq.	%	
ACCEPTED	Remainder	14	43.75	22	78.57	36
REJECTED	Factor-class C	<u>18</u>	<u>56.25</u>	<u>6</u>	<u>21.43</u>	<u>24</u>
TOTAL		32	100.00	28	100.00	60

Statistics:

Chi-square = 7.54

p (probability that the obtained chi-square arises from random fluctuation) = .02

r (coefficient of correlation) = .35

gamma (number of misplaced individuals correctly reclassified by rejecting only Factor-class C) = 10

r' (coefficient of correctivity) = .34

TABLE 11 (Continued)

C

Another grouping primarily to maximize proportion of rejected
LOW men.

		LOW		HIGH		Total
		Freq.	%	Freq.	%	
ACCEPTED	Remainder	18	56.25	28	100.00	46
REJECTED	Factor-class D	<u>14</u>	<u>43.75</u>	<u>0</u>	<u>0.00</u>	<u>14</u>
TOTAL		32	100.00	28	100.00	60

Statistics:

Chi-square = 15.97

p (probability that the obtained chi-square arises from random fluctuation) = .0003

r (coefficient of correlation) = .52

gamma (number of misplaced individuals correctly reclassified by rejecting only Factor-class D) = 13

r' (coefficient of correctivity) = .42

TABLE 12

Composition of Factor- and Remainder-classes, VP menPercentage of men so responding

	Response or Preference Arrangement is:	Rather than:	Factor-class		Remainder	TOTAL
			A (N-16)	B (N-6)	Class (N-38)	
Factor A	1*Meteorologist	Educational	100	33	26	46
(plus):		Officer				
Strong Aver-	2*Meteorologist	Ground School	100	33	24	45
sion to In-		Instructor				
structor	3*Observation	Primary Flight	100	0	26	43
Duty	Scout Plane	Instructor				
	4*Navy Transport	Primary Flight	100	50	30	81
Core Items	Pilot	Instructor				
	5*Navigator on	Student Advisory	94	83	79	80
	Patrol Boat	Officer				

Factor B	6 P is 1st or	Third - sixth	88	100	87	88
(plus):	2nd choice					
Strong Sys-	7 Both P and B	Last four	81	100	79	78
tematic	are included					
Preference	in first 2					
for Multi-	choices					
engine,	8 Choices	Not "blocked"	75	100	47	60
plus aver-	"blocked"					
sion to VO	9 Both TB and VO	First four	13	100	26	30
Core Items	are included					
	in last 2					
	choices					

*These items are from the Aviation Preference Check List.

TABLE 13

Composition of Factor- and Remainder-classes, CV Men

Response or Preference Arrangement is:	Rather than:	Factor Classes				Remainder	TOTAL
		A (N-42)	B (N-20)	C (N-27)	D (N-24)	Class (N-27)	
CORE ITEMS:							
A1.First three choices not all CV	All CV	100	15	100	0	100	72
A2.First two choices did not include TB	Include TB	100	65	96	55	67	77
A3*Work involving few details	Work involving many details	100	70	15	71	44	64
A4*Visit a friend	Write letters	100	100	70	83	59	83

ASSOCIATED ITEMS:							
A5.Choices not "blocked"	"Blocked"	91	35	56	29	100	67
A6.B among first three choices	Last three	88	0	96	0	100	64
A7.F or SB among first two choices	Both F and SB among last four choices	86	100	37	100	81	79
A8.First three choices include 2 CV, 1 non-CV	Other arrangement	60	15	0	0	100	40
A9.Last two choices include TB and VO	Other arrangement	45	0	52	0	15	26
A10*Supervisory responsibility	Technical responsibility	69	100	56	4	56	57

FACTOR A (plus)

"The Wanted Man"

*These items are from the Aviation Preference Check List.

TABLE 13 (Continued)

Response or Preference Arrangement is:	Rather than:	Factor Classes				Remainder	TOTAL
		<u>B</u> (N-20)	<u>A</u> (N-42)	<u>C</u> (N-27)	<u>D</u> (N-24)	Class (N-27)	
CORE ITEMS:							
B1.First 3 choices include at least 2 CV type	1 or more	100	60	0	100	100	68
B2.F or SB among first 2 choices	Both F and SB among last four choices	100	86	37	100	81	79
B3.B among last three choices	Among first three	100	12	4	100	0	36
B4*Visit a friend	Write letters	100	100	70	83	59	83
B5*Supervisory res- ponsibility	Technical respon- sibility	100	69	56	4	56	57
B6*Grounded for physical defect	Killed in a crash	100	86	96	33	67	84

ASSOCIATED ITEMS:							
B7.Assignment was first or second choice	3rd, 4th, 5th, or 6th	85	64	26	75	81	65
B8.First 3 choices were <u>all</u> CV type	Other arrangement	85	0	0	100	0	28
B9.Choices "blocked"	Not "blocked"	65	9	44	71	0	33
B10*Work involving few details	Work involving many details	70	100	15	71	44	64

FACTOR B (plus)

"The Wanted Man with Strong CV Preferences"

*These items are from the Aviation Preference Check List.

TABLE 13 (Continued)

Response or Preference Arrangement is:	Rather than:	Factor Classes				Remainder	TOTAL
		<u>C</u> (N-27)	<u>A</u> (N-42)	<u>B</u> (N-20)	<u>D</u> (N-24)	Class (N-27)	(N-140)
CORE ITEM:							
C1.First 3 choices included only 1 or no CV type	2 or 3 CV types	100	40	0	0	0	32

ASSOCIATED ITEMS:							
C2.B among first 3 choices	Last 3	96	88	0	0	100	64
C3.Both B and P among first 3 choices	Other arrangement	93	36	0	0	0	28
C4.Assignment was 3rd, 4th, 5th, or 6th choice	1st or 2nd	74	36	15	25	19	35
C5*Work involving many details	Work involving few details	85	0	30	29	56	36
C6*Ground school instructor	Athletic officer	56	19	5	13	22	23

FACTOR C (minus)

"The Misplaced Multi-engine Man or Instructor"

*These items are from the Aviation Preference Check List.

TABLE 13 (Continued)

Response or Preference Arrangement is:	Rather than:	Factor Classes				Remainder	TOTAL
		<u>D</u> (<u>N-24</u>)	<u>A</u> (<u>N-42</u>)	<u>B</u> (<u>N-20</u>)	<u>C</u> (<u>N-27</u>)	Class (<u>N-27</u>)	

CORE ITEM:

D1. First 3 choices were <u>all</u> CV type	Other arrangement	100	0	85	0	0	28
---------------------------------------------	-------------------	-----	---	----	---	---	----

ASSOCIATED ITEMS:

D2. Choices "blocked"	Not "blocked"	71	9	65	44	0	33
D3* Technical responsibility	Supervisory responsibility	96	31	0	44	44	43
D4* Athletic officer	Ground school instructor	87	81	95	44	78	77
D5* Work involving few details	Work involving many details	71	100	70	15	44	64
D6* Killed in a crash	Grounded for physical defect	67	14	0	4	33	16
D7* Primary flight instructor	Navy transport pilot	63	14	10	7	22	16
D8* Sailing	Motor boating	50	31	30	33	26	33

FACTOR D (minus)

"The Inconsistent Unwanted Man"

*These items are from the Aviation Preference Check List.

APP. AI

NATC PENSACOLA

SPECIALIZED TRAINING PREFERENCE SHEET

(Date) _____

NAME _____ FLIGHT CLASS _____
(Print) (Last) (First) (Middle)

RANK & CORPS _____ AGE LAST BIRTHDAY _____ HEIGHT _____ WT. _____

Preference for type of specialized training:
(Specify VB2, VO/VCS, VP, VF, VTB, VSB)

1st Choice _____	VB2	--Multi-Engine landplane	
	VP	--Multi-Engine seaplane	
2nd Choice _____	VO/VCS	--Observation or	
		Scout Training	
3rd Choice _____	VF	--Fighters	
	VTB	--Torpedo	
4th Choice _____		Bombers	Carrier
	VSB	--Scout	Training
5th Choice _____		(Dive)	
		Bombers	
6th Choice _____			

If I were assigned VO/VCS I would be:

- () delighted
- () very pleased
- () pleased
- () no opinion
- () disappointed
- () very disappointed

If I were assigned VP I would be:

- () delighted
- () very pleased
- () pleased
- () no opinion
- () disappointed
- () very disappointed

If I were assigned VSB I would be:

- () delighted
- () very pleased
- () pleased
- () no opinion
- () disappointed
- () very disappointed

If I were assigned VTB I would be:

- () delighted
- () very pleased
- () pleased
- () no opinion
- () disappointed
- () very disappointed

If I were assigned VF I would be:

- () delighted
- () very pleased
- () pleased
- () no opinion
- () disappointed
- () very disappointed

If I were assigned VB2 I would be:

- () delighted
- () very pleased
- () pleased
- () no opinion
- () disappointed
- () very disappointed

Have you had aviation experience previous to Naval flight training?
Yes ___ No ___ If Yes, explain, giving length of service, type of plane,
duties and responsibilities, etc.

APPENDIX AII

AVIATION PREFERENCE CHECK LIST

INSTRUCTIONS: Each of the following items consists of a pair of activities, hobbies or flight assignments. In each case, imagine that you had to choose one of the two alternatives and then quickly choose. If A, black out the space marked A on the answer sheet; if B, black out the space marked B. Don't omit any pair. Don't take time to consider the situation but indicate your first reaction. If in doubt, guess!

- | | |
|---------------------------------------------------------------------|--------------------------------------------------------------------|
| 1. A Fly a fast airplane
B Fly a slow airplane | 20. A People older than yourself
B People younger than yourself |
| 2. A Deal with things
B Deal with people | 21. A Contact flying
B Instrument flying |
| 3. A Fly single engine planes
B Fly multi-engined plane | 22. A Formation flying
B Flying alone |
| 4. A Do a job by yourself
B Supervise others on the job | 23. A "Air Trails"
B "Air Facts" |
| 5. A Fly large heavy planes
B Fly small light planes | 24. A Boxing
B Tennis |
| 6. A Fly with others in the ship
B Fly solo | 25. A Poker
B Bridge |
| 7. A Short flights
B Long flights | 26. A Write letters
B Visit a friend |
| 8. A Work involving few details
B Work involving many details | 27. A "Dog fighting"
B Formation flying |
| 9. A Change from place to place
B Work in one location | 28. A Diving
B Swimming |
| 10. A Aerobatics
B Instrument flight | 29. A Wrestling
B Golf |
| 11. A Shore-based duty
B Fleet duty | 30. A Hunting
B Fishing |
| 12. A Fly low
B Fly high | 31. A Handling horses
B Operating a machine |
| 13. A Present a report in writing
B Present a report verbally | 32. A Teaching adults
B Teaching children |
| 14. A Give orders
B Follow orders | 33. A City life
B Farm life |
| 15. A Read a book
B Go to movies | 34. A Married
B Single |
| 16. A Regular work hours
B Irregular work hours | 35. A Radio
B Navigation |
| 17. A Play basketball or football
B Coach basketball or football | 36. A Military drill
B Athletics |
| 18. A Pilot a plane
B Ride in a plane as crew member | 37. A Aerodynamics
B Meteorology |
| 19. A Order people
B Persuade people | 38. A Gunnery practice
B Aircraft identification |

39. A Arguments
B Reading
40. A Popular Mechanics
B Readers Digest
41. A Comics
B Sporting Page
42. A A date
B A "stag" party
43. A Trap shooting
B Hunting
44. A Sailing
B Motor boating
45. A Reading a book
B Reading a magazine
46. A Hiking
B Swimming
47. A Be only man at "hen party"
B Be one of many stags at dance
48. A Have student freeze on controls
B Have ship catch fire in the air
49. A Solo students yourself
B Have check pilot solo your students
50. A Teach students throughout primary
B Specialize in one stage of instruction
51. A Ride a motorcycle
B Drive a car
52. A Make a bomb run
B Strafe a train
53. A Repair a motor
B Tell others how to
54. A Dancing
B Go to a show
55. A Associate with senior officers
B Associate with junior officers
56. A Be an all round athlete
B Be a champ in one sport
57. A Mountain climbing
B Golf
58. A Western movies
B Comedies
59. A Play hockey
B Play handball
60. A Wear a dress uniform
B Wear fatigue clothes
61. A Play cards
B Play table tennis
62. A Workout on parallel bars
B Dive from high places
63. A Referee a game
B Play a game
64. A Write a story or play
B Direct a play
65. A Technical responsibility
B Supervisory responsibility
66. A Race a horse
B Train a horse
67. A Study mathematics
B Study history
68. A Daylight bombing
B Night bombing
69. A Bomb an airbase
B Bomb a city
70. A Shoot down an enemy plane
B Strafe enemy infantry
71. A Be grounded for physical defect
B Be killed in a crash
72. A Be forced down at sea
B Be captured by the enemy
73. A Be bombed by enemy aircraft
B Be strafed by enemy aircraft
74. A Be skipper of a submarine
B Be skipper of a destroyer
75. A Make a parachute jump
B Swim 3 miles to land
76. A High altitude bombing
B Dive bombing
77. A Rear gunner in a heavy bomber
B Gunner in a torpedo plane
78. A Be wing man in a V formation
B Be leader in a V formation

79. A Help provide a fighter screen for bombers qq.
B Pilot bomber under fighter screen
80. A Be lost in the overcast
B Make a belly-landing
81. A Lose your gunner
B Lose your navigator
82. A Bomb as you saw fit
B Bomb under specific orders
83. A Strafe hostile infantry
B Bomb a hostile fort
84. A Shoot down an enemy in flames
B Bomb a hostile destroyer
85. A Be forced down at sea
B Be forced down on the desert
86. A Bail out at 10,000 feet
B Lose your engine on takeoff
87. A Fight from formation
B Fight in individual dogfights
88. A Engage in night combat
B Fight in full daylight
89. A Be Air Attache in London
B Be C.O. of NRAB
90. A Navigator on Patrol Boat
B Pilot on Patrol Boat
91. A Dive Bomber Pilot
B Fighter Pilot
92. A Primary Flight Instructor
B Intermediate Flight Instructor
93. A Primary Flight Instructor
B Check Flight Instructor
94. A Instrument Flight Instructor
B Operational Flight Instructor
95. A Intermediate Flight Instructor
B Operational Flight Instructor
96. A Signal Officer on a Carrier
B Fighter Pilot
97. A Athletic Officer
B Patrol Boat Pilot
98. A Primary Flight Instructor
B Torpedo Bomber Pilot
100. A Torpedo Bomber Pilot
B Observation and Scouting Pilot
101. A Ground School Instructor
B Athletic Officer
102. A Fighter Pilot
B Instrument Flight Instructor
103. A Observation Scouting Pilot
B Primary Flight Instructor
104. A Supply Officer
B Educational Officer
105. A Torpedo Bomber Pilot
B Fighter Pilot
106. A Meteorologist
B Student Advisory Officer
107. A Ground School Instructor
B Instrument Flight Instructor
108. A Fighter Pilot
B Observation and Scouting Pilot
109. A Primary Flight Instructor
B Student Advisory Officer
110. A Instrument Flight Instructor
B Primary Flight Instructor
111. A Navy transport pilot
B Operations officer
112. A Instrument Flight Instructor
B Patrol Boat Pilot
113. A Patrol Boat Pilot
B Observation and Scouting Pilot
114. A Educational Officer
B Meteorologist
115. A Operations Officer
B Navigation Patrol Bomber
116. A Athletic Officer
B Instrument Flight Instructor
117. A Observation Scouting Pilot
B Navy Transport Pilot
118. A Primary Flight Instructor
B Meteorologist

- | | |
|-------------------------------------------------------------------|---------------------------------------------------------------|
| 119. A Fighter Pilot
B Patrol Boat Pilot | 139. A Primary Flight Instructor
B Supply Officer |
| 120. A Primary Flight Instructor
B Ground School Instructor | 140. A Meteorologist
B Patrol Boat Pilot |
| 121. A Supply Officer
B Meteorologist | 141. A Navigator on Patrol Boat
B Ground School Instructor |
| 122. A Navigation on Patrol Boat
B Primary Flight Instructor | 142. A Educational Officer
B Instrument Flight Instructor |
| 123. A Navy Transport Pilot
B Torpedo Bomber Pilot | 143. A Student Advisory Officer
B Navigator on Patrol Boat |
| 124. A Torpedo Bomber Pilot
B Dive Bomber Pilot | 144. A Ground School Instructor
B Navy Transport Pilot |
| 125. A Patrol Boat Pilot
B Primary Flight Instructor | 145. A Instrument Flight Instructor
B Operations Officer |
| 126. A Fighter Pilot
B Navigator on Patrol Boat | 146. A Athletic Officer
B Meteorologist |
| 127. A Primary Flight Instructor
B Navy Transport Pilot | 147. A Supply Officer
B Instrument Flight Instructor |
| 128. A Primary Flight Instructor
B Athletic Officer | 148. A Navy Transport Pilot
B Student Advisory Officer |
| 129. A Torpedo Bomber Pilot
B Patrol Boat Pilot | 149. A Operations Officer
B Ground School Instructor |
| 130. A Meteorologist
B Instrument Flight Instructor | 150. A Ground School Instructor
B Supply Officer |
| 131. A Navy Transport Pilot
B Fighter Pilot | |
| 132. A Patrol Boat Pilot
B Observation and Scouting Pilot | |
| 133. A Instrument Flight Instructor
B Navigator on Patrol Boat | |
| 134. A Torpedo Bomber Pilot
B Operations Officer | |
| 135. A Navy Transport Pilot
B Instrument Flight Instructor | |
| 136. A Operations Officer
B Primary Flight Instructor | |
| 137. A Ground School Instructor
B Meteorologist | |
| 138. A Fighter Pilot
B Operations Officer | |

APP. AIII

Today's Date _____

Your name _____ File # _____
(Last) (First) (Middle)

Rank _____ USNR Squadron _____

#1 Name _____ Rank _____ Squadron _____
(Last) (First) (Middle)

The reasons I have circled below apply to this man:

1	2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21	22

a b c d e

Other comments on this man: (Write below)

#2 Name _____ Rank _____ Squadron _____
(Last) (First) (Middle)

The reasons I have circled below apply to this man:

1	2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21	22

a b c d e

Other comments on this man: (Write below)